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Abstract

Many finance theories predict that the capital structure affects firm value, which implies that the changes in leverage have an impact on stock returns. Most of the existing literature however has been focusing on the determinants of the capital structure. Using a sample of U.S. public firms during 1975-2002, we document a significantly negative effect of leverage changes on next-quarter stock returns. This effect remains significant after controlling for other firm characteristics such as ROE, book-to-market, firm size, and past returns.

We propose and test several hypotheses to explain the observed effect. We find that the negative effect is stronger for the firms with a higher leverage level. This is consistent with a dynamic view of the pecking-order model that an increase in leverage reduces firms' debt capacity and may lead to future underinvestment. Further tests confirm the negative effect of current leverage change on future investment. In contrast, our results cannot be explained by the trade-off theory, default premium, the market timing theory, or the operational signaling story. Specifically, we find that deviation from the target leverage ratio has no impact on the stock returns, inconsistent with the trade-off theory (which implies an optimal, or partially optimal, leverage ratio). In addition, the change of long-term debt affects stock returns more than the change of short-term debt, and the one-year expected return following leverage change does not increase, both of which are inconsistent with the default risk premium hypothesis. Our results are not driven by firms' market timing activities. A firm times the market by issuing new equity (repurchasing stocks) when its equity is over- (under-) valued, which implies a positive relation between the leverage change and stock return. We also do not find support for the view that leverage increase signals poor future operating performance. Finally, we show that the return effect of leverage change contains information that cannot be explained by the popular pricing factors. This sheds new light on the link between capital structure choice and empirical asset pricing.

Capital structure dynamics and stock returns

Since Modigliani and Miller (1958), there have been many studies that have examined firms' capital structure choices and their implications. Popular models include the tradeoff models, the pecking-order models, and the market-timing models, among others. The empirical work has thus far mainly focused on the tests of these models and the determinants of the capital structure.[1] In this paper, we examine how the capital structure dynamics affect stock returns. This issue is closely related to firms' capital structure choice, and is important for several reasons.

First, since many theories suggest that the choice of capital structure affects the cost of capital, the risk profile, and the investment opportunity, among other aspects of a firm, then a change in capital structure should indicate either a change or a review of the firm value. Because equity holders get the residual claim of the firm, we expect the changes in leverage ratio to have an impact on stock returns.

Moreover, different models often have different implications about how capital structure affects the equity value. Examining the relation between leverage change and stock returns provides an alternate channel to test different capital structure theories. For example, in the static pecking-order theory, firms' financing preference is in the order of retained earning, riskless debt, risky debt, and equity. Hence, an increase in leverage is not necessarily bad news. However, in the dynamic version of the pecking-order model (Myers (1984)), an increase in leverage lowers a

[1] For tradeoff models and empirical evidence, see Deangelo and Masulis (1980), Harris and Raviv (1990), Titman and Wessel (1988), Stulz (1990), Opler and Titman (1993, 1994), Berens and Cuny (1995), Rajan and Zingles (1995), Jung, Kim, and Stulz (1996), Lang, Ofek, and Stulz (1996), and Hovakimian, Opler and Titman (2001), Hennessy and Whited (2005), among others. For pecking order models and empirical evidence, see Myers (1984), Myers and Majluf (1984), Narayanan (1988) and Heinkel and Zechner (1990), Shyam-Sunder and Meryers (1999), Fama and French (2002), Frank and Goyal (2003), and Leary and Roberts (2005b), among others. For market-timing models and empirical evidence, see Stein (1996), Baker and Wurgler (2002), Alti (2004), Hovakimian (2004a, 2004b), Welch (2004), and Huang and Ritter (2005), among others. For determinants of capital structure, see Titman and Wessels (1988) and Frank and Goyal (2004), among others. Frank and Goyal (2005) provides a comprehensive survey of the literature.

firm's safe debt capacity and may lead to future underinvestment. Thus, it lowers equity value. Alternatively, according to the tradeoff theory, any deviation from the optimal capital structure would result in lower stock prices. The default risk premium story on the other hand implies that an increase in a firm's leverage may increase the default risk and equity holders may demand a higher risk premium for holding the stock.

Finally, by conducting our study in calendar time using a comprehensive sample, we are able to directly relate the capital structure literature to the empirical asset pricing literature. Doing so helps us better understand the dynamics of the equity market.

We study the dynamics of the leverage ratios of all U.S. public firms that have both CRSP and Compustat records during the period of 1975-2002. Our focus is on the effect of leverage change on a firm's stock returns. We summarize our empirical procedure and results as follows.

Every month we sort stocks into deciles according to their leverage change rankings for the previous fiscal quarter. Since different firms end their fiscal quarter in different months, we rebalance the portfolio every month, and the component stocks in each portfolio are different each month. We find a significant negative effect of leverage change on the portfolio returns. The results hold for both equal- and value-weighted portfolios. For the value-weighted portfolios, the monthly return difference between the top and bottom deciles is 0.55% a month, or over 6.8% annually.

Using leverage change of the previous quarter avoids the possible feedback effect of stock returns on leverage. Therefore, the documented negative effect goes from leverage change to stock price, but not the other way. Note that the information about leverage change is usually revealed during the following quarter, therefore we interpret the leverage change and the stock returns as contemporaneous.[2]

To test the robustness of our findings on other firm characteristics such as earnings and growth opportunities, we run the Fama-Macbeth (1973) type cross-sectional regressions. We find that after controlling for ROE, book-to-market ratio, size, past returns, and other firm characteristics, the leverage change remains negative and statistically significant.

We next test a number of hypotheses that might explain the negative effect of leverage change on stock returns. According to the dynamic pecking-order model (Myers (1984)), an increase in leverage may reduce a firm's safe-debt capacity and increase the possibility of forgoing positive net present value (NPV) projects in the future.[3] Therefore, an increase in leverage results in a lower stock return, holding others things equal. Our empirical findings are consistent with this argument.

Furthermore, this hypothesis implies that the negative effect should be stronger for firms that already have limited debt capacity (higher leverage). To test this implication, we conduct a two-way sort based on the lagged leverage level and leverage change. We find that the negative effect of leverage change on stock returns is stronger for firms with higher leverage levels. We also find that the leverage change is negatively related to several measures of future investment.

Another potential explanation is the tradeoff theory. The tradeoff theory suggests that there exists an optimal (or target) leverage level, and any deviation from that level has a negative effect on stock price. Our initial results do not support this argument. To further test the tradeoff theory, we estimate the optimal (or partially optimal) leverage ratio and calculate the deviation

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[2] We find a similar negative relation between leverage change and the same-quarter stock returns. However, it is not clear in this case whether leverage increase causes lower return or the lower return causes higher leverage. Therefore, to avoid the endogeneity problem we measure stock returns in the quarter after the leverage change.

[3] Lemmon and Zender (2004) show that debt capacity is an important factor in determining a firm's financing choice. Their evidence supports the dynamic pecking order theory, but contradicts the tradeoff theory.

from the optimal level. We sort the sample into ten portfolios by leverage deviation and find no evidence that returns across these ten portfolios display any apparent pattern. To account for possible slow adjustment to target leverage, we also sort sample into ten portfolios by the change in leverage deviation and again find no apparent return patterns across the portfolios.

Several recent studies document the effects of default risk on equity returns. They find that firms with higher default probability on average earn higher stock returns, implying a default premium. Since leverage is an important component of the default likelihood measure, an increase in a firm's leverage might increase the possibility of default. As a result, its default premium increases and the current stock price drops. Our initial findings seem to be consistent with the default premium hypothesis. However, further tests do not agree. First, short-term debt should matter more than long-term debt for default risk. However, we find a significant, negative effect of the change in long-term debt leverage on stock returns, but a much weaker effect of the change in short-term debt leverage. Second, if the increase in default premium causes the short-term return decline, we expect to observe higher future returns for firms with larger leverage increase, but the one-year return after the leverage change does not exhibit any apparent pattern. Both results suggest that the increase in default risk alone cannot explain the negative effect of leverage change on stock returns.

Our empirical evidence also cannot be explained by the market timing hypothesis, which argues that a firm issues new equity (repurchases stock) when its equity is overvalued (undervalued). Thus, the leverage change caused by a firm's market timing action is positively related to stock returns, which is opposite to our results. As a robustness check, we exclude the months in which a firm announces a SEO or stock repurchase, and the results are similar.

Dimitrov and Jain (2003) provided an alternate hypothesis based on the firms' operating performance. They argue that if the managers have private information that the firm's future operating performance may deteriorate, they will increase the debt level to prepare for it. Therefore, leverage increase is a negative signal for future operating performance. We test this hypothesis and find no empirical support for it.

Finally, we examine whether the return difference on portfolios sorted by leverage change can be explained by existing asset pricing factors. We find that the return difference cannot be explained by the Fama-French factors or the momentum factor, and the regression alphas of these portfolios demonstrate patterns similar to those of the raw returns. This result has important implication for the construction of performance benchmarks and investors' portfolio allocation decision. However, the abnormal alphas should not be interpreted as an implementable trading strategy due to the reporting delays, and therefore not against efficient market hypothesis.

The paper is organized as follows. Section I discusses the data. Section II presents the main results. Section III tests several potential explanations of the main results. Section IV relates the capital structure dynamics with empirical asset pricing. Section V concludes.

I. Data

Our sample consists of all U.S. public firms with information available on both the CRSP monthly data file and the Compustat quarterly data file from 1975 to 2002. Following the literature convention, we exclude all financial and utility firms (Banking, Insurance, Real Estate, Trading, and Utilities industries as defined by Fama and French [1997]). We also exclude firms with non-positive book values of equity and negative total liabilities.

The literature measures capital structure in two ways: book leverage, which equals the book value of total liabilities divided by the book value of total assets; and market leverage, which equals the book value of total liability divided by the sum of the book value of total liabilities and the market value of shareholders' equity. Market leverage is not suitable for our study, since its change is mechanically correlated with stock return. Therefore, we use book leverage to measure capital structure. Compared to the market value, the book value of assets is also more stable.

Table I reports the summary statistics of the leverage and the leverage change of the firms in our sample. The average firm has a leverage ratio of 0.47. We define leverage change as the change in book leverage from the previous quarter. We note that although the average leverage change per quarter is small, the cross-sectional standard deviation is substantial. This is because that the leverage change can be either positive or negative. A positive 10% change and a minus 10% change result in zero mean, yet the standard deviation is 6.7%. The size and book-to-market of firms in our sample are also comparable to other studies.

Insert Table I about here

II. Main results

Although different theoretical models have different implications on a firm's capital structure choice, these theories all suggest that a change in the capital structure indicates a change or a review of the firm value. Therefore, we expect that leverage change has an impact on stock returns.

For each month during 1975-2002, we rank all firms in our sample by their leverage change during the previous fiscal quarter. We then sort the firms into ten portfolios according to their leverage change rankings, with portfolio one having the lowest leverage change and portfolio ten having the highest. Since different firms end their fiscal quarters in different months, we perform the sorting monthly, and the resulting portfolios are different in every month. We calculate the monthly returns for each portfolio, both equal-weighted and market-value-weighted.

Insert Table II about here

Table II reports the average monthly returns for each of the ten portfolios. There is a clear decreasing trend on the average portfolio returns for both equal-weighted and value-weighted portfolios. For equal-weighted portfolios, the average monthly return equals 2.02% for portfolio one and 1.03% for portfolio ten. The return difference between the two portfolios is 0.99%, statistically significant at the 1% level. The value-weighted portfolios exhibit a similar negative effect of leverage changes on stock returns. The monthly return difference between portfolio one and portfolio ten is 0.55%, also significant at the 1% level.

Firms' capital structure choice depends on a number of firm characteristics such as earnings and book-to-market ratio. Meanwhile many studies find that firm-specific characteristics can help explain the cross-sectional returns (see, e.g., Fama and French (1992)). Daniel and Titman (1997) argue that characteristic-based models do a better job of explaining cross-sectional returns. It is possible that the explanatory power of leverage change on stock returns might be a proxy for other firm characteristics. To examine the marginal effect of leverage change on cross-sectional stock returns, we run Fama and Macbeth (1973) type cross-sectional regressions of the firm-level stock returns on leverage change during the previous quarter, among other control variables.

$$r_{it+1} = \alpha_t + \beta_{\Delta LV,t} \Delta LV_t + \beta'_{control,t} control\, vector\,, \tag{1}$$

where ΔLV_t is the leverage change during the previous quarter.

The control variables include the stock beta, market value of equity at the end of last month, book-to-market ratio and ROE at the end of the last quarter, the past one-month and past one-year returns, and the leverage level at the beginning of the last quarter. The capital structure literature identifies a long list of variables that might affect firm leverage choice. Since the determinants of the capital structure are not the focus of this paper, we do not include all of these variables in our regressions. Instead, we include the past leverage level to summarize the cumulative effects those variables may have on firms' leverage.

Insert Table III about here

Table III reports the time series averages of the estimated regression coefficients, and the corresponding *t*-statistics. In regression (1) we include only the leverage change; in regression (2) we also include the past leverage level; and in regression (3) we add all other control variables. For all three regressions, the average coefficients for leverage change are negative and statistically significant at the 1% level. Including the control variables slightly lowers the coefficient of leverage change, but the average leverage change coefficient remains significant. The results are also economically significant. A 10% increase in the leverage ratio leads to a 34 basis points decrease in average monthly stock return after controlling for various firm characteristics. Among the control variables, leverage level itself is not significant. Nor does the CAPM beta have explanatory power, consistent with the findings of Fama and French (1992).

The average coefficient of log(size) is significant and negative, consistent with the size effects. Both book-to-market and ROE coefficients are highly significant. Consistent with existing literature, we find significant coefficients for both the past one-month- and one-year-returns. The cross-sectional regression results suggest that the effect of capital structure innovation on stock returns are not proxy for the effects of earnings and other firm characteristics. [4]

III. Hypotheses testing and interpretations

Why is there a negative effect of leverage change on stock returns? In this section, we test a number of hypotheses that might explain the observed return pattern.

A. Dynamic pecking-order model

According to the dynamic pecking-order model of Myers (1984), increasing leverage reduces a firm's safe debt capacity and hence increases the possibility of forgoing positive NPV projects in the future, resulting in a negative effect of leverage increase on stock returns. This prediction is consistent with our empirical results. The dynamic pecking-order model also suggests that the negative effect of leverage change on stock returns is stronger for firms that already have lower debt capacity, i.e. firms with higher debt levels. To test this implication, we conduct a two-way sort. We first sort our sample into five portfolios by the firm's leverage level at the beginning of the previous quarter. Within each of the five portfolios, we then sort the firms into five sub-portfolios by the leverage change during the last quarter. This procedure produces a five-by-five portfolio matrix.

Insert Table IV about here

[4] As a robustness test, we exclude all firm/year observations with negative ROE, and we find very similar results.

Table IV reports the average monthly returns for the five-by-five portfolio matrix. Panel A reports the results for the equal-weighted portfolios and Panel B reports the value-weighted portfolios.

Consistent with the dynamic pecking-order model, we find that the negative effect of leverage change on stock returns is stronger for stocks that already have a relatively high leverage level. For the equal-weighted portfolios, there is a clear positive relation in the return difference between the top and bottom leverage-change portfolios and the leverage level. In the lowest leverage quintile, the return difference between the top and bottom leverage-change portfolios is only 0.19%, with an insignificant *t*-statistic of 0.1. In contrast, in the highest level quintile, the corresponding return difference is 1.68%, with a *t*-statistic of 9.24. The results of the value-weighted portfolios are similar. The return differences between the top and bottom leverage-change portfolios equal -0.23% in the lowest leverage level quintile and 0.74% in the highest quintile.

To further test the dynamic pecking-order theory, we directly examine how leverage change affects the change in future investment. Similar to Fama and French (2002), we measure the future investment by the average values of the Q ratio, the investment rate, and the R&D and capital expenditures over the next four quarters. Q equals the market value of total assets divided by the book value of total assets, where the market value of total assets equals the market value of equity and the book value of total liabilities. The investment rate equals the change in total assets from last quarter normalized by the total assets of the last quarter. The R&D and capital expenditure equals the sum of the R&D and capital expenditure expenses divided by the total assets of the last quarter. We define the change in investment as the average next-four-quarter values of these investment measures minus the current quarter values. We then regress the measures of future change in investment on the current-quarter leverage change, book-to-market ratio, log market value of equity, and ROE. Table V shows that the coefficients for the leverage change in all four regressions are negative and statistically significant at the 1% level, suggesting that a current increase in leverage tends to lower the future investment. This result is consistent with the dynamic pecking-order theory.

Insert Table V about here

B. Tradeoff models

An important implication of the tradeoff models is that there is an optimal (or target) leverage ratio. Any deviation (increase or decrease) from that optimal level is bad news and has a negative impact on stock price. Our initial results do not appear to support this argument. If the change in leverage is a deviation from the target leverage level, the tradeoff models predict that stock returns are lower for portfolios at both ends. Therefore, the pattern of the portfolio returns is an inverse U-shape. However, our earlier results show that the relation between leverage change and stock return is monotonic. This finding is inconsistent with the prediction of the tradeoff models.

An implicit assumption we make above is that the firms' previous quarter leverage ratio are at the optimal level, which may not be true. To address this issue, we take two steps to calculate a firm's deviation from its optimal leverage. First, we run cross-sectional regression to estimate a firm's target leverage in each quarter. Similar to Fama and French (2002), we estimate the following cross-sectional regression:

$$LV_{t+1} = b_0 + b_1 LV_t + b_2 V_t / A_t + b_3 E_t / A_t + b_4 Dp_t / A_t + b_5 RDD_t + b_6 RD_t / A_t + b_7 \ln(A_t) + e_{t+1} \ , \tag{2}$$

where *LV* is the leverage level, *V* is the total market value of assets, *A* is the total book value of assets, *E* is the earnings before interest and tax, *Dp* is the depreciation, *RD* is the R&D expenses, *RDD* is a dummy variable that takes the value of one if R&D expenses is not zero or missing, *BM* is the book-to-market ratio, *e* is the new innovation of leverage, and subscript $_t$ denotes the time period.

Second, we use the estimated coefficients and the current-quarter firm characteristics to calculate the predicted value of the next-quarter leverage target for every firm. Then, for each firm we subtract the target leverage level from the actual leverage level. We define the absolute value of the difference as the leverage deviation from the optimal level. We next sort the sample into ten portfolios by the leverage deviation.[5]

Table VI reports the average monthly returns of portfolios sorted by the leverage deviation. The results are not consistent with the tradeoff story. The return difference between the top and bottom portfolios is insignificant (0.13% per month for equal-weighted portfolios and 0.1% for value-weighted portfolios, both statistically insignificant). In fact, there is no apparent pattern across the deciles.

An alternative interpretation of the results is that it takes more than one period for firms to adjust their capital structure to the target level, possibly due to adjustment costs.[6] Therefore, it is the change in deviation that may affect stock returns. An increase in deviation from target leverage lowers stock returns and a decrease in deviation increases stock returns.

To test this prediction, we calculate the quarterly change in the deviation from target leverage for each firm and sort the sample into ten portfolios by the change in leverage deviation.

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[5] An additional advantage of this approach is that the target leverage is allowed to be time-varying.
[6] See Fischer, Heinkel, and Zechner (1989), Flannery and Rangan (2004), Huang and Ritter (2005), and Leary and Roberts (2005a).

Table VI shows again that the ten portfolios do not exhibit any apparent return patterns. Thus, our results are inconsistent with this interpretation. Baker and Wurgler (2002), Strebulaev(2003), and Welch (2004) show that firms don't actively adjust the capital structure to the target level. Consistent with their evidence, we find that deviation from leverage target does not affect stock returns.

Insert Table VI about here

C. Default risk premium hypothesis

If a firm uses risky debt financing, then default risk exists. All else equal, the higher the leverage, the higher the probability that the firm may default. Vassalou and Xing (2004) show that firms with higher default likelihood have higher future stock returns, suggesting a positive default premium. At a first glance, our results may be consistent with their findings. An increase in leverage may increase the default risk, and given a positive default premium, the immediate stock price drops. However, further tests do not support this hypothesis.

First, according to the default premium story, firms with a higher leverage increase should have higher future expected returns. We test this hypothesis by examining the returns of the ten portfolios for the next year. Panel A of Table VII shows that for both equal- and value-weighted portfolios the return differences between portfolio one and portfolio ten are insignificant, either economically or statistically.

However, it is possible that the default premium can only be detected in the firms with higher leverage level. To further test whether our results are driven by the default risk, we perform a two-dimension sort of the sample, first by leverage level and then by leverage change.

Panel B of Table VII shows that even among firms with higher leverage levels, the firms with the highest leverage increase do not exhibit higher next-year returns than do the firms with the highest leverage decrease.

Insert Table VII about here

Second, since the short-term debt is more relevant for default risk, the default risk premium hypothesis predicts a stronger effect of the change in short-term debt on the contemporaneous stock returns. To test this prediction, we decompose the leverage into short-term debt leverage (total short-term liabilities divided by total assets) and long-term debt leverage (total long-term liabilities divided by total assets). We repeat the earlier portfolio sorting procedure, using the long- and short-term debt leverage change as the ranking criteria.

Insert Table VIII about here

Table VIII shows that the monthly returns of the portfolios sorted by the long-term debt leverage still display a clear deceasing trend for these portfolios. The return difference between portfolio one and ten remain statistically significant, and the magnitudes also match the results obtained using total leverage change. The result is quite different when we repeat the procedure using the short-term debt leverage change. Table VIII shows that although the return difference for equal-weighted portfolio one and portfolio ten is still statistically significant, the magnitude is lower than its long-term counterpart. For the value-weighted portfolios, the return difference is no longer significant, and the point estimates of the monthly return difference between portfolio one and portfolio ten drops drastically to 0.23%. The combined evidence shows that the negative effect of leverage change on stock returns cannot be explained by default risk.

D. Market timing hypothesis

The market timing hypothesis predicts that a firm issues new equity when its equity is overvalued and repurchases stock when its equity is undervalued. Baker and Wurgler (2002), among others, argue that the market timing actions have persistent effect on a firm's capital structure. However, our results are not likely to be driven by firms' market timing actions, such as SEOs and stock repurchases. An SEO decreases leverage but also has a negative announcement return, which is opposite to our finding that leverage decrease leads to higher stock returns. Similarly, a stock repurchase increases leverage but has a positive announcement return, which is again contrary to our findings. Therefore, our results cannot be driven by firms' market timing actions.

E. Operational performance hypothesis

Dimitrov and Jain (2003) find an inverse relation between the annual change in leverage caused by operating activities and the next-year stock returns. They argue that managers may have private information that the firm's operating performance will deteriorate in the future. In response, the managers borrow more money to prepare for that. Therefore, increasing leverage signals poor future operating performance, and results in poor stock return. As support for their argument, they find a negative relation between leverage change and future ROE.

However, ROE may not be an appropriate measure of future operating performance, since it is mechanically related to leverage change through the leverage effect, interest expenses, and tax shield. To address this issue, we measure operating performance with ROA and EBITDA. These two variables measure the overall operation of the entire firm, and both are not directly determined by capital structure and are calculated before the interest expenses and tax.

To test the relation between current leverage change and future operating performance, we regress the average ROA and EBITDA over the next four quarters on the current-quarter leverage change and other control variables. Table IX shows that the coefficients of the current leverage change are positive and statistically significant at the 1% level, suggesting that at least in our sample, managers do not increase leverage to prepare for the poor future operating performance.

Insert Table IX about here

IV. Can existing asset pricing factors explain the negative return effect of leverage change?

In this section we examine whether the return patterns we have observed thus far can be explained by popular asset pricing factors. We consider three models: The Capital Asset Pricing Model (CAPM), the Fama-French (1993) three-factor model, and the Carhart (1997) four-factor (three-factor plus the momentum factor). For each portfolio constructed in Table II, we run the following time-series regression:

$$r_{it} - r_{ft} = \alpha_i + \beta_i' F_t + \varepsilon_{it} \quad \text{(for i=1 to 10)}, \tag{3}$$

where r_{it} s are the monthly portfolio returns. F_t is a vector of pricing-factor returns including the market excess return, Fama-French size factor SMB, book-to-market factor HML, and the momentum factor UMD. We obtain the return series of these factors and the one-month T-bill rate from Kenneth French's website.[7] Alphas are the risk-adjusted returns for the portfolios. If these factors can explain the cross-sectional returns of the ten portfolios sorted by leverage changes, then we expect that the alphas to be similar across these portfolios.

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[7] We thank Ken French for making these data publicly available. For details on the construction of these factor returns, we refer readers to French's website http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.

Insert Table X about here

Table X reports the regression alphas, as well as the multivariate *t*-test results. Panel A reports the results for equal-weighted portfolios and Panel B reports the results for the value-weighted portfolios. The basic message is that the asset pricing factors cannot fully explain the negative return effect of leverage change. For both the equal- and the value-weighted portfolios, we still observe a decreasing trend on portfolio alphas as leverage change increases. For the equal-weighted portfolio in the CAPM model, the alpha equals 0.7% for portfolio ten and -0.31% for portfolio one. The alpha difference between portfolio one and ten is 1.02% per month, statistically significant at the 1% level. The magnitude of the alpha difference is also similar to the raw return difference, suggesting that the negative effect of leverage change on stock returns cannot be explained by the market factor. Adding more factors does not alter the results. For both the Fama-French three-factor model and the four-factor model, we still find the decreasing trend in return as leverage change increases, and the difference in alphas between portfolio one and portfolio ten equals 0.96% in the three-factor model and 0.63% in the four-factor model, both statistically significant at the 1% level. Finally, the Gibbens-Ross-Shanken (1989) test of the hypothesis that all ten alphas are equal is also strongly rejected in all three models.

The results for the value-weighted portfolios are similar. For the CAPM and both the three- and four-factor models, the alpha differences between the top and bottom portfolios equal 0.49%, 0.5%, and 0.45% a month, all statistically significant at the 5% level. Their magnitude is also similar to the raw return difference of 0.55%. In all three models, we again reject the null hypothesis that all ten alphas are equal at the 5% level.

Our results show that capital structure innovation contains information about cross-sectional returns that cannot be explained by popular asset pricing factors, which suggests that investors should consider the additional dimension when constructing benchmarks. Since this leverage innovation effect cannot be diversified away by the (existing) systematic factors, it can also affect investors' portfolio allocation decision. These issues deserve further exploration in future research. However, we note that because of the delay in leverage ratio reporting, the significant alphas do not represent abnormal returns on an implementable trading strategy, and the results are not against the efficient market hypothesis.

V. Conclusions

Capital structure is one of the central focuses in the corporate finance literature. Various theoretical models, such as the tradeoff, pecking-order, and market timing models, have been proposed to explain firms' capital structure. These models also suggest that leverage changes affect firm value and stock prices.

In this paper, we focus on the effect of change in firms' leverage on stock returns. Using a sample of U.S. public firms, we show that firms with higher leverage changes on average have lower returns. Fama-MacBeth (1973) type cross-sectional regressions suggest that the marginal effect of leverage change on stock returns remains significant after we control for earnings and other firm characteristics.

We test whether our results can be explained by the pecking-order models, the default risk premium, the tradeoff models, or the operational performance hypothesis. Our results are consistent with a dynamic version of the pecking-order theory, which suggests that an increase in leverage reduces safe debt capacity and leads to future underinvestment. This theory predicts a negative effect of leverage change on stock returns. Further, this effect should be stronger for firms that already have high leverage. We find empirical supports for both predictions. In addition, we find a negative effect of leverage change on future investment, suggesting that increasing leverage does lead to future underinvestment.

Our results provide little support for the default premium hypothesis. First, there is no evidence that firms with a higher leverage increase have higher future returns. Second, there is a significant, negative effect of the change in long-term debt leverage on stock returns, but a much weaker effect for the change in short-term debt leverage. Both results are not consistent with the default risk premium hypothesis.

Nor do the results appear to be consistent with the tradeoff models. Tradeoff models imply an optimal (target) capital structure. Deviation from the target should have a negative effect on stock price. Yet, when we sort stocks into portfolios based on the deviation or change in deviation from the target leverage, we do not find significant return patterns across these portfolios.

Nor can our results be explained by the market-timing hypothesis, which predicts that a firm will lower debt financing and increase equity financing if its equity is overvalued. As a result, leverage decrease signals overvaluation of equity and has a negative effect on stock price, which is opposite to our findings. Further tests also suggest that the operational performance hypothesis proposed in Dimitrov and Jain (2003) is unlikely to explain the results for our sample.

Finally, we show that the leverage innovation effect contains information about the cross-sectional stock returns that cannot be explained by popular asset pricing factors. This result has important implication for the construction of performance benchmarks and investors' portfolio allocation decision.

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Table I

Summary Statistics

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. At the end of each fiscal quarter, we calculate for each firm the change in leverage from the previous fiscal quarter. We calculate leverage as the ratio between the book value of total liabilities and the book value of total assets.

Variables	Mean	Median	Standard deviation
Market value of equity ($million)	946	63	7,407
Leverage	0.47	0.48	0.22
Leverage change	0.0045	0.0005	0.0673
Book-to-market ratio	0.79	0.58	0.88

Table II

Monthly Stock Returns of Portfolios Sorted by Last-Quarter Leverage Changes

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. At the end of each fiscal quarter we calculate for each firm the change in leverage from the previous fiscal quarter. We calculate leverage as the ratio between the book value of total liability and the book value of total assets. We then sort our sample into ten portfolios by leverage change. We require each portfolio to have at least 30 stocks. We rebalance the portfolios monthly. Since in every month there are some firms that end their fiscal quarter. The equally-weighted portfolio returns equal the simple average of monthly stock returns of all stocks in a portfolio. The value-weighted portfolio returns equal the weighted average monthly stock returns of all stocks in a portfolio. We determine weights by the market value of equity at the end of the last month.

Leverage change Portfolio	Average equal-weighted portfolio returns (%)	Average value-weighted portfolio returns (%)
1 (lowest ΔLV)	2.02	1.42
2	1.93	1.37
3	1.89	1.35
4	1.69	1.24
5	1.64	1.40
6	1.49	1.04
7	1.39	1.02
8	1.25	0.87
9	1.19	1.04
10 (highest ΔLV)	1.03	0.87
Difference (1 – 10)	0.99	0.55
t-statistics	(7.28)***	(2.84)***

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table III

Fama-Macbeth (1973) cross-sectional regressions

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. This table reports the average coefficients and their *t*-statistics in the Fama-Macbeth (1973) type cross-sectional regressions. In each month, we run cross-sectional regressions of all available firms. The dependent variable is the stock return in the month. The independent variables include the leverage change and ROE at the most recent fiscal quarter end, the leverage level at the beginning of the most recent quarter, the log size, beta, and book-to-market ratio at the end of last month, the prior-month return, and the prior-year return. We estimate beta using the last 60-month stock returns. We measure size by the market value of equity. We require each regression to have at least 30 observations. We report the average coefficients of all regressions and report their *t*-statistics in parentheses.

Independent variables and Statistics	Dependent variable = monthly stock return (%)		
	(1)	(2)	(3)
Leverage change	-4.57	-4.70	-3.42
	(-8.08)***	(-7.76)***	(-7.64)***
Leverage level		0.20	0.05
		(0.65)	(0.20)
Beta			0.06
			(0.20)
Log(size)			-0.14
			(-2.65)***
Book-to-market			0.92
			(12.85)***
ROE			1.12
			(4.58)***
Prior one-year return			0.49
			(4.16)***
Prior one-month return			-6.55
			(-15.02)***
N	336	336	336

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table IV

Monthly returns of portfolios sorted by last-quarter leverage level and leverage change

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. We first sort the sample into five portfolios by leverage level at the beginning of the last quarter. We then sort each of the five portfolios into five subportfolios by leverage change of the last quarter. We require each portfolio to have at least 30 stocks. We rebalance the portfolios monthly, since in every month there are some firms that end their fiscal quarter. The equally weighted portfolio returns equal the simple average of monthly stock returns of all stocks in a portfolio. The value-weighted portfolio returns equal the weighted average monthly stock returns of all stocks in a portfolio. We determine the weights by market value of equity at the end of the last month.

Leverage Change Portfolio		Leverage Portfolio 1 (lowest)	2	3	4	5 (highest)
Panel A: Equally weighted portfolio returns (%)						
1 (lowest)	Mean	1.38	1.74	1.99	2.25	2.45
2	Mean	1.37	1.72	1.69	2.00	2.25
3	Mean	1.57	1.61	1.66	1.54	1.65
4	Mean	1.44	1.61	1.42	1.23	1.00
5 (highest)	Mean	1.37	1.17	1.04	0.88	0.77
Difference (1 – 5)	Mean	0.19	0.57	0.94	1.37	1.68
	t-statistics	(0.10)	(3.31)***	(6.53)***	(8.15)***	(9.24)***
Panel B: Value weighted portfolio returns (%)						
1 (lowest)	Mean	0.75	1.56	1.48	1.41	1.85
2	Mean	1.00	1.40	1.35	1.47	1.86
3	Mean	1.23	1.20	1.24	1.22	1.44
4	Mean	0.91	1.08	1.02	1.09	0.92
5 (highest)	Mean	0.98	1.01	1.04	0.99	1.11
Difference (1 – 5)	Mean	-0.23	0.54	0.44	0.42	0.74
	t-statistics	(-0.70)	(1.87)*	(1.70)*	(1.76)*	(2.82)***

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table V

Future investment regression

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. This table reports the average coefficients and their *t*-statistics in the Fama-Macbeth (1973) type cross-sectional regressions. In each quarter during 1975-2001, we run cross-sectional regressions of all available firms. The dependent variables include the future changes in Q, the investment rate, the depreciation, and the R&D and capital expenditure. We calculate the future changes of these variables as the average value of the next four quarters minus the current value. Q equals the market value of total assets divided by the book value of total assets, where the market value of total assets equals the market value of equity and the book value of total liabilities. The investment rate equals the change in total assets from last quarter normalized by the total assets of last quarter. The R&D and capital expenditure equals the sum of the R&D and expenditure expenses divided by the total assets of the last quarter. The independent variables include the change in leverage change, the log market value of equity, the book-to-market ratio, and ROE. We report the average coefficients of all regressions and present their *t*-statistics in parentheses.

	Dependent variables = Change in		
Independent variable and statistics	*Q*	*Investment rate*	*R&D and capital expenditure*
	(1)	(2)	(3)
Leverage change	-0.889 (-6.72)***	-0.853 (-5.07)***	-0.076 (-8.36)***
Book-to-market	0.149 (10.47)***	-0.006 (-0.62)	0.001 (2.50)**
Log(size)	-0.031 (-7.97)***	-0.005 (-8.27)***	-0.000 (-2.05)**
ROE	0.105 (2.25)**	-0.047 (-5.70)***	0.000 (0.40)
N	108	108	76

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table VI

Monthly returns of portfolios sorted by deviation from leverage target

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. Following Fama and French (2002), we first estimate the a cross-sectional regression of leverage of the following form

$$LV_{t+1} = b_0 + b_1 LV_t + b_2 V_t / A_t + b_3 E_t / A_t + b_4 Dp_t / A_t + b_5 RDD_t + b_6 RD_t / A_t + b_7 \ln(A_t) + e_{t+1}$$

where *LV* is the leverage level, *V* is the total market value of a firm, *A* is the total book value of a firm, *E* is earnings before interest and tax, *Dp* is depreciation, *RD* is R&D expenses, *RDD* is a dummy variable that takes the value of one if R&D expenses are not zero or missing, *e* is the error term, and subscript $_t$ denotes the time period. We then use the coefficients and the last-quarter information to calculate the predicted value of the current-quarter leverage target for every firm. The deviation from the leverage target equals the absolute difference between the actual leverage and the leverage target. We then sort our sample into ten portfolios by the leverage deviation. To address the possible slow adjustment to leverage deviation, we further calculate the change in leverage deviation from the last quarter and sort the sample into ten portfolios according to the changes in leverage deviation. We require each portfolio to have at least 30 stocks. We rebalance the portfolios monthly, since in every month there are some firms that end their fiscal quarter. The equal-weighted portfolio returns equal the simple average of monthly stock returns of all stocks in a portfolio. The value-weighted portfolio returns equal the weighted average monthly stock returns of all stocks in a portfolio, where the weights are given by market value of equity at the end of the last month.

	Leverage deviation portfolios		Change in leverage deviation portfolios	
Portfolio ranking	Equal-weighted returns (%)	Value-weighted returns (%)	Equal-weighted returns (%)	Value-weighted returns (%)
1 (lowest ΔLV)	1.60	1.27	1.49	1.13
2	1.74	1.18	1.63	1.22
3	1.70	1.12	1.55	1.29
4	1.58	1.07	1.66	1.27
5	1.56	1.16	1.64	1.07
6	1.55	1.13	1.63	1.17
7	1.46	1.10	1.62	0.98
8	1.41	1.25	1.49	1.32
9	1.47	1.24	1.42	1.24
10 (highest ΔLV)	1.47	1.17	1.50	1.17
Difference (1 – 10)	0.13	0.10	-0.01	-0.04
t-statistics	(0.65)	(0.43)	(-0.12)	(-0.18)

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table VII

Cumulative next-year returns of portfolios sorted by leverage changes

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. At the end of each fiscal quarter, we calculate for each firm the change in leverage from the previous fiscal quarter. We calculate leverage as the ratio between the book value of total liability and the book value of total assets. We then sort our sample into ten portfolios by leverage change. We require each portfolio to have at least 30 stocks. We rebalance the portfolios monthly, since in every month there are some firms that end their fiscal quarter. We then calculate the cumulative portfolio returns over the one-year period starting with the next fiscal quarter after forming the portfolios. We first sort the sample into five portfolios by leverage level at the beginning of last quarter. We then sort each of the five portfolios into five sub-portfolios by leverage change of the last quarter. We then calculate the cumulative portfolio returns over the one-year period starting the next fiscal quarter after forming the portfolios. The equal-weighted portfolio returns equal the simple average of monthly stock returns of all stocks in a portfolio. The value-weighted portfolio returns equal the weighted average monthly stock returns of all stocks in a portfolio, where the weights are given by market value of equity at the end of the last month.

Panel A: Cumulative next-year returns of portfolios sorted by leverage changes

	1 (lowest)	2	3	4	5	6	7	8	9	10 (highest)	*10-1*	T-stat (10-1)
Equal-weighted	17.93	20.42	19.74	19.07	18.03	18.00	17.56	17.77	17.74	18.56	-0.63	(-1.09)
Value-weighted	13.62	15.07	14.74	14.22	14.30	14.20	13.53	15.05	14.03	12.82	0.80	(1.00)

Panel B: Cumulative next-year returns of portfolios sorted by leverage level and leverage change

Leverage Change Portfolio	Equal-weighted portfolio returns					Value-weighted portfolio returns				
	Leverage Portfolio					Leverage Portfolio				
	1 (lowest)	2	3	4	5 (highest)	1 (lowest)	2	3	4	5 (highest)
1 (lowest)	17.98	17.09	18.69	20.24	20.32	13.42	16.37	13.42	14.69	16.86
2	16.87	17.87	18.83	19.21	21.97	13.59	14.00	13.78	15.02	17.91
3	17.25	18.25	17.89	17.46	19.36	11.45	15.32	13.38	14.13	16.28
4	16.40	17.78	16.46	16.46	18.48	10.70	14.79	12.99	14.91	15.71
5 (highest)	17.63	16.95	17.78	18.53	20.09	12.82	12.24	13.54	16.16	17.38
1-5	0.35	0.14	0.90	1.72	0.22	0.59	4.12	-0.12	-1.47	-0.52
T-stat(1-5)	(0.46)	(0.25)	(1.31)	(2.46)***	(0.34)	(0.41)	(3.24)***	(-0.11)	(-1.60)	(-0.47)

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table VIII

Monthly returns of portfolios sorted by changes in long-term or short-term leverage

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. At the end of each fiscal quarter, we calculate for each firm the change in the long- and short-term leverages from the previous fiscal quarter. We calculate the long-term leverage as the ratio between the book value of long-term liability and the book value of total assets. We calculate short-term leverage as the ratio between the book value of short-term liability and the book value of total assets. We then sort our sample into ten portfolios by the change in the long- or short-term leverages. We require each portfolio to have at least 30 stocks. We rebalance the portfolios monthly, since in every month there are some firms that end their fiscal quarter. The equal-weighted portfolio returns equal the simple average of monthly stock returns of all stocks in a portfolio. The value-weighted portfolio returns equal the weighted average monthly stock returns of all stocks in a portfolio, where the weights are given by market value of equity at the end of the last month.

	Long-term leverage change portfolios		Short-term leverage change portfolios	
Portfolio ranking	Equal-weighted returns (%)	Value-weighted returns (%)	Equal-weighted returns (%)	Value-weighted returns (%)
1 (lowest ΔLV)	2.01	1.47	1.71	1.19
2	1.98	1.38	1.59	1.18
3	1.81	1.33	1.47	1.22
4	1.69	1.19	1.56	1.24
5	1.65	1.39	1.63	1.33
6	1.55	1.09	1.59	1.15
7	1.24	1.19	1.62	1.10
8	1.21	1.10	1.62	1.04
9	1.05	1.03	1.65	1.39
10 (highest ΔLV)	1.28	0.97	1.09	0.95
Difference (1 – 10)	0.73	0.49	0.62	0.23
t-statistics	(7.50)***	(2.98)***	(4.88)***	(1.19)

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table IX

Future operating performance regressions

The sample consists of all nonfinancial and nonutility firms that have a positive book value of equity, non-negative book value of total liabilities, and are available from both the CRSP monthly file and Compustat quarterly file during 1975-2002. This table reports the average coefficients and their *t*-statistics in the Fama-Macbeth (1973) type cross-sectional regressions. We run cross-sectional regressions for each quarter during 1975-2001. The dependent variables include the average ROA and EBITDA of the next four fiscal quarters. We calculate ROA as the ratio between earnings before interests and tax (EBIT) and the beginning-period total assets. We calculate EBITDA as the sum of EBIT and depreciation and amortization divided the beginning-period total assets. The independent variables include the leverage change, ROA, EBITDA, the log market value of equity, the book-to-market ratio of current fiscal quarter, and the leverage level of last quarter. We require each regression to have at least 30 observations. We report the average coefficients of all regressions, and present their *t*-statistics in parentheses

Independent variable and statistics	*Dependent variable = Future ROA*		*Dependent variable = Future EBITDA*	
	(1)	(2)	(3)	(4)
Leverage change	0.019	0.021	0.015	0.018
	(5.56)***	(6.12)***	(4.55)***	(5.25)***
Current ROA	0.518	0.483		
	(39.02)***	(37.43)***		
Current EBITDA			0.519	0.484
			(38.84)***	(37.37)***
Leverage level		0.008		0.008
		(4.95)***		(5.53)***
Log(size)		0.002		0.002
		(15.48)***		(17.28)***
Book-to-market		-0.001		-0.001
		(-2.58)***		(-3.52)***
N	108	108	108	108

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.

Table X

Risk-adjusted returns of portfolios sorted by leverage changes

This table reports the regression intercepts (alphas) of the leverage-change-sorted portfolio returns described in Table II. The dependent variables of these regressions are the portfolio returns in excess of the one-month T-bill rate. In the Capital Asset Pricing Model, the independent variable is the market excess returns. In the Fama-French three-factor model, the independent variables include the market excess return, the size factor, and the book-to-market factor. In the four-factor model, the independent variables include the market excess return, the size factor, the book-to-market factor, and the momentum factor. We obtain the factor returns and the one-month T-bill rates from Ken French's website. Panel A reports results for equal-weighted portfolios, and Panel B reports those for value-weighted portfolios.

Panel A: Equal-weighted portfolios

		1 (Lowest)	2	3	4	5	6	7	8	9	10 (highest)	*10-1*	GRS test (*p*-value)
CAPM	α (%)	0.70	0.70	0.65	0.47	0.43	0.27	0.15	-0.01	-0.09	-0.31	1.02	
	t-stat	2.78***	3.36***	3.55***	2.77***	2.46**	-1.47	-0.8	-0.03	-0.36	-1.05	7.44***	<.0001***
3-factor	α (%)	0.47	0.38	0.33	0.13	0.11	-0.02	-0.09	-0.22	-0.25	-0.49	0.96	
	t-stat	3.26***	3.10***	3.24***	1.33	1.06	-0.16	-0.76	-1.66*	-1.57	-2.37**	6.86***	<.0001***
4-factor	α (%)	0.56	0.54	0.50	0.32	0.31	0.20	0.18	0.07	0.06	-0.07	0.63	
	t-stat	3.80***	4.52***	5.16***	3.43***	3.38***	1.92*	1.77*	0.58	0.42	-0.37	5.16***	<.0001***

Panel B: value-weighted portfolios

		1 (Lowest)	2	3	4	5	6	7	8	9	10 (Highest)	*10-1*	GRS test (*p*-value)
CAPM	α (%)	0.13	0.17	0.17	-0.28	0.27	-0.09	-0.15	-0.16	-0.36	0.13	0.49	
	t-stat	0.79	1.55	1.59	1.38	2.93	-1.07	-1.57	-1.11	-2.48**	-2.09**	2.52**	0.0010***
3-factor	α (%)	0.16	0.20	0.22	0.13	0.23	-0.05	-0.10	-0.21	-0.04	-0.34	0.50	
	t-stat	1.13	1.78	2.00**	1.45	2.48**	-0.53	-1.05	-1.89*	-0.3	-2.49**	2.51**	0.0106**
4-factor	α (%)	0.03	0.15	0.19	0.16	0.24	0.03	0.01	-0.17	0.04	-0.41	0.45	
	t-stat	0.23	1.35	1.72*	1.75*	2.60***	0.43	0.08	-1.51	0.26	-2.98***	2.18**	0.0199**

***, **, and * denote statistical significance at %1%, 5%, 10% levels, respectively.